Socioeconomic Analysis of the Atlantic Menhaden Commercial Bait and Reduction Fishery

A Proposal in Response to the:

Atlantic States Marine Fisheries Commission Request for Proposals

Principal Investigator:

John C. Whitehead
Professor, Department of Economics
Appalachian State University
Boone, NC 28608
Phone: (828)262-6121
Email: whiteheadjc@appstate.edu

Co-Principal Investigator:

Jane Harrison
Coastal Economics Specialist
North Carolina Sea Grant
Raleigh, NC
Phone: (919)513-0122
Email: jane_harrison@ncsu.edu

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Project Description

<u>Introduction</u>

In this project we will collect and analyze primary and secondary data, both quantitative and qualitative, from the U.S. Atlantic menhaden commercial and recreational fishery markets. The goal is to provide a document that characterizes the socioeconomic dimensions of menhaden fisheries stakeholders and can be used to support economic analysis of alternative menhaden allocations.

In this research we will address the distributional consequences of management change on the Atlantic menhaden commercial bait and reduction fisheries. We will provide the high priority outputs as detailed in Tables 1 and 2 of the RFP. In particular we will present findings in landings and revenues from the bait fishery by state, gear and year. We will describe vessel and gear characteristics, estimate employment and participation in the fishery, identify subsidies, exits and substitute products. We will also consider the processing and distribution sectors, including the demand and supply side of the markets. For the reduction fishery we will present results considering trends in landings, revenues, costs and participation in the fishery. Other factors considered will include jobs supported by the reduction fishery, market impacts and any industry subsidies.

In addition to the collection and analysis of quantitative data, we will employ qualitative case studies of the bait fishery to explore social equity and identify political and social resources upon which those fishery stakeholders rely. Cases will be developed that link the harvesting and processing and distribution sectors across the supply chain and investigate how social organizations and leadership impact economic resilience.

In the remainder of this proposal we will describe some of the previous socioeconomic research conducted on menhaden fishery, research objectives, methods, outputs, qualifications of the investigators and the budget.

Literature Review

There are only a few published articles that focus on the Atlantic menhaden fishery in the economics literature. Each of these analyze the menhaden fishery 30 or more years ago following the first menhaden fishery management plan in 1981. Blomo (1987, 1988) and Blomo, Orbach and Maiolo (1988) estimate the impacts from ASMFC management plans on the menhaden fishery using a bioeconomic model with temporal and spatial variation. The biological component of the model accounts for menhaden catch as the product of yield per recruit and the number of recruits. The economic component is the difference in total revenue and total cost. Total revenue is the sum of fish meal and fish oil revenue where these are the product of oil and meal price, oil and meal yield per catch and menhaden catch. The cost function is the sum of fishing cost and reduction plant operating cost. Fishing cost is the product of fishing days and daily cost. Reduction plant cost is the product of daily costs and operating days. The ASMFC policy examined is a shorter fishing season (i.e., elimination of the winter season in North Carolina) to increase yield per recruit. Simulations find that the shorter fishing season would reallocate catch and revenues toward states north of North Carolina and lead to greater industry profits.

There are two more recent and larger reports on the menhaden fishery. Kirkley et al. (2011), in a report funded by the Virginia Marine Resources Commission, examines the social and economic impacts of changes in the reduction fishery on the Reedsville area economy. The goal of this study was to assess the tradeoff between market and nonmarket benefits of the fishery if the Chesapeake Bay menhaden quota was reallocated. The loss of the reduction industry would generate a 14% and 8% decline in county income and employment, respectively. In addition, an economic impact model finds that shutting down the Chesapeake menhaden fishery would lead to a loss of $10 million in income. Reducing the Atlantic Ocean menhaden quota from 141 to 50 thousand metric tons would reduce sales from $60 to $21 million and profits from $14 to $2 million. Two reasons given for a reduction in the menhaden quota are an increase in the economic impacts in the recreational fishing industry for species that depend on menhaden as prey and the greater nonmarket values of a healthy menhaden stock. In a review of the literature the study finds no empirical evidence to support the recreational fishing benefits. Nonmarket valuation analysis using primary data indicated that a decrease in the menhaden catch is valued

at $28 in net benefits per household and quota maintenance is valued at $50 per household. In the aggregate there is a gain in net benefits of $110 million for maintaining the status quo relative to a decrease in quota.

The second report is Dudley (2012), who wrote his North Carolina State University economics dissertation examining several empirical issues in the menhaden fishery. First, he considers whether fish meal and fish oil prices are part of an international, national, regional or local market. He finds that U.S. fish meal prices are not correlated with international market prices and that U.S. fish oil prices are positively correlated with international prices. Second, he examines whether Omega Protein gained market power with the closure of Beaufort Fisheries. Using stock market price data and event study methods, he finds that stock prices for Omega Protein rose with the close of Beaufort Fisheries. This suggests that investors felt that Omega Protein gained some market power and would be able to raise prices for menhaden products. Third, he examines the economic effects of changes in regulations affecting the menhaden fishery using inverse demand models for fish oil and fish meal. He finds that the price elasticity of demand for menhaden meal is between -1.2 and -1.4. Menhaden oil is more responsive to price changes with a price elasticity of demand between -4.1 and -4.2. He uses these demand elasticities to estimate the effect of reduced harvesting rates described in Addendum V to Amendment 1 to the Atlantic Menhaden Fishery Management Plan (ASMFC 2011). The loss of welfare to menhaden meal and oil consumers from reduced harvest rates is estimated to be $26 to $27 million ($2010).

Alignment with the Topics Outlined in the RFP

Bait Fishery

The Atlantic menhaden bait fishery represents a growing proportion of the commercial fishery and warrants closer inspection of the relevant socioeconomic implications. In recent years (2007-2013) bait landings have averaged approximately 23% of the total coastwide menhaden landings. This is up from an average of approximately 11% of total landings for the period 1985-2000 (SEDAR 2015). Atlantic menhaden are harvested for bait in almost all Atlantic coast states and are used for bait in commercial (e.g. American lobster, blue crab) and sport fisheries (e.g. striped bass, bluefish). Yet the relative importance of the bait fishery for various markets is unknown.

We will fill that gap by collecting and analyzing data on the harvesting and processing and distribution sectors across the menhaden bait fishery supply chain.

Meager data is available to explain the rise of the bait fishery. The increase in the bait fishery has been attributed partially to better data collecting in the Virginia snapper rig bait seine fishery, the relative decline in coastal reduction landings because of plant closures, and increased interest in menhaden for bait purposes because of recent limitations on catch of Atlantic herring, a preferred bait for the lobster fishery (SEDAR 2015). Because previous socioeconomic studies have focused their attention primarily on the reduction fishery, we have little evidence to go on with regard to changes in the bait fishery (Cheuvront 2004; Kirkley et al. 2011; Dudley 2012). The factors that contribute to the rise of the bait fishery require further study to determine its socioeconomic importance to both commercial and recreational markets.

Some significant data limitations exist regarding the menhaden bait fishery. Systems for reporting bait landings have historically been incomplete, particularly for Atlantic menhaden because of the nature of the fishery and its unregulated marketing (SEDAR 2015). Data limitations also exist because menhaden taken as by-catch in other commercial fisheries are often reported as "bait" together with other fish species. Additionally menhaden harvested for personal bait use or sold "over-the-side" likely go unreported.

We propose to characterize both the harvesting sector and the processing and distribution sector of the menhaden bait fishery using a multi-methodological research design. Especially in the social sciences, using a mix of qualitative and quantitative methods can be advantageous for obtaining richer and more detailed information about a given research question (e.g., Nisbet & Goidel 2007). The combination of methods takes advantage of the strengths of each while making up for their weaknesses. For example, a quantitative approach to social research often yields highly reliable results that can generalize to a broader population; a qualitative approach tends to have strength in the validity of the findings and provide more detailed information about human values, perceptions, and behavior for a smaller number of research subjects (Babbie 2013). Finally, while quantitative analysis can adequately address efficient policy options, qualitative approaches are better suited to analyze socially equitable policies.

In characterizing the socioeconomic dimensions of the bait fishery, primary and secondary data will be collected and analyzed on the following topics:

Menhaden bait fishery harvesting sector

1. *Landing trends* will be analyzed by state and gear type. The distinction between true area of harvest versus state landed will be explored, as well as concentration in specific ports.
2. *Average and total revenue trends* will be analyzed by state and year. Information will be gathered on ex-vessel value, revenue distribution, operational costs, and the value of menhaden harvested under quota versus value under bycatch allowance.
3. *Vessel and gear characteristics* data will be collected and analyzed.
4. *Sector employment* will be analyzed by state. Alternative employment opportunities will be explored. Additionally annual revenue shares by species and state will be used to identify alternative targets and sources of fishery revenues.
5. *Fishery participation* will be analyzed with data on the number of fishermen and boats including historic and current employment. Additionally the extent to which fishermen focus on menhaden as a primary catch and during what seasons will be explored. Finally participant information relating to demographics, attitudes, beliefs, norms, values, social organization, and leadership will be collected and analyzed.
6. *Subsidies* (e.g. fuel subsidies, tax breaks) will be identified and characterized.
7. *Buy-backs* will be identified to characterize exits from the bait fishery.
8. *Substitute bait products* will be identified and characterized.

Menhaden bait fishery processing and distribution sector

1. *Number of bait retailers and wholesalers that sell menhaden* by state will be determined, as well as number and types of employees, income by position, total bait sales, and proportion of menhaden sales.
2. *Product Distribution* will be determined to identify the clients or purchasers (both commercial and recreational) of menhaden. Additionally the product forms and prices will be identified, including wholesale and retail. Finally data will be collected on preferred forms and user type.

<u>Reduction Fishery</u>

The reduction fishery is inherently different from the bait fishery in terms of its temporal and spatial scales. Also, the reduction fishery has been studied intensively. As such, analysis of the reduction fishery will take a different approach from analysis of the bait fishery, relying primarily on quantitative data. The empirical approach is described in a later section of this proposal.

As described above in the literature review Kirkley et al. (2011) conducted an extensive socioeconomic study of the reduction fishery. The study considered economic impacts of Omega Protein on the regional economy, effects of menhaden stock on recreational fisheries and the nonmarket value of menhaden allocation changes. To the extent permitted by the available data we will update the Kirkley et al. (2011) analysis of economic impacts. In addition, we will analyze trends and model the determinants of landings and revenues in the harvesting sector of the reduction fishery. Given that the Atlantic menhaden industry is vertically integrated, prices will be obtained from the Gulf of Mexico reduction fishery and the Atlantic and Gulf bait fisheries.

We will more thoroughly analyze the data presented in Kirkley et al. (2011) and develop an economic model of the reduction fishery. We will analyze time-series data on landings, prices, costs and effort to determine rent (i.e., profitability) in the fishery. We will analyze time-series data on fishing capacity utilization and the fixed and variable costs of fishing (i.e., number of vessels). We will analyze time-series data on the quantity of quota allocated, quota landed, and menhaden processed to determine the effect of these constraints on the fishery.

Considering changes in trends in the reduction fishery, we will update Kirkley et al. (2011) in terms of changes in the regional economy affected by the reduction fishery. We will estimate changes in participation in the fishery including trends in number of employees, their demographics and estimate the share of income these employees represent in their communities.

We will analyze county level economic and demographic data from U.S. government agencies to assess changes in population, education, employment and alternative opportunities in the counties impacted by the reduction fishery. We will use the reduction fishery trends analysis to

update Kirkley et al. in terms of the importance of the reduction fishery in the community (i.e., direct and indirect jobs created and incomes).

We will analyze USDA and other data on intermediate producer and final consumer products from the fish meal and fish oil markets. This analysis will consider substitutes for the product (e.g., Gulf of Mexico menhaden, soybean oil) and the trends in these substitute prices. We will identify direct and indirect subsidies and their socioeconomic effects.

Secondary Research Outputs

We will conduct a literature review of studies that estimate the ecological, non-market (e.g., recreational bait) and market (e.g., fish oil) values of menhaden. We will also review studies that consider potential indirect impacts and mortalities (e.g. impingement/entrainment at power plants). As requested in the RFP, the review will include description and analysis of methodologies used, general findings, and caveats. In the rest of this section we provided a brief review of the known literature.

There are only two known studies in the nonmarket valuation literature that consider menhaden. Whitehead, Haab and Parsons (2003) estimate the social benefits of avoiding fish kills that predominately affect menhaden in North Carolina and Virginia. While there was no scientific evidence that fish kills negatively affected seafood safety, the public was concerned about risk from eating contaminated seafood. The contingent valuation method was used to estimate willingness to pay for a mandatory seafood inspection program in response to menhaden fish kills. Respondents were presented with the referendum question: "Suppose that the proposed mandatory seafood inspection program is put to a vote in the November national election. If more than one-half of all people voted for it the Department of Commerce would put it into practice. If you knew the price of your portion of your average seafood meal would go up by $[price amount] but the price of all other food stays the same, would you vote for or against it?" Respondents could answer "for," "against," or "don't know." Eighty-five percent of the respondents who were presented with the $1 seafood meal price change voted for the seafood inspection program. Eighty percent, 74%, and 65% of the respondents voted for the seafood

inspection program when the price change rose to $3, $5, and $7. This study only indirectly considers the nonmarket value of menhaden.

Whitehead, et al. (2012) examine the results of the survey of Maryland and Virginia residents reported in Kirkley et al. (2011). They focus on a comparison of three survey modes/samples (random dial telephone, random address mail and internet panel). They first describe a policy that would reduce the menhaden quota. There are two versions of the survey, a 10% reduction and a 50% reduction in quota: "To decrease the harvest of the menhaden 'reduction' fishery in the Bay by 10% (50%) will require more rigorous monitoring. This approach could decrease the total sales of menhaden by about $6 ($30) million, wages and salaries paid to fishermen and processor employees by about $1.1 ($5.7) million, employment by 30 (150) individuals and taxes paid to Virginia by approximately $340,000 ($1.7 million). The impact on the Maryland economy would be minimal." Respondents are then asked: How concerned are you about the decrease of menhaden harvest on the Virginia economy? The percentage of respondents who are somewhat concerned or very concerned (combined) is 55%. The amount of the reduction in quota increases respondent concern in the telephone and internet samples. Respondents are then asked if they would vote in favor of the monitoring program (that would enforce the reduction in quota) at a randomly assigned increase in their household income tax. Respondents are told that "If a majority of all households in Virginia and Maryland voted against the proposal then it would fail, commercial fishing of menhaden would remain at current levels and it would cost you nothing." The percentage of respondents who would vote for the proposal is 41%. Respondents in the telephone and internet samples are less likely to vote for the proposal as the tax amount increases. Those in the internet sample are less likely to vote for the proposal if they are concerned about its effects on the Virginia economy. These data can be used to indirectly estimate the influence of ecological benefits but there are limitations to its application in the current policy context.[1]

Richkus and McLean (2000) estimate that a significant number of menhaden are lost to impingement and entrainment (I&E) at power plants each year. This literature will be reviewed

[1] This study is limited in that it was based on the premise that the menhaden stock was not overfished and overfishing was not occurring. Subsequent to the survey design, it was determined that the menhaden stock was subject to overfishing (ASMFC, 2011).

with a goal of determining whether a damage estimate could be developed for Atlantic menhaden I&E using benefit transfer methods. For example, Gentner (2009) estimates the economic costs of I&E at the Bay Shore power plant in Ohio. Biological models are used to estimate that the power plant results in the loss of 55 million predator and prey fish species. About 15% of those are fish species valued by commercial fishermen and recreational anglers (e.g., walleye). Benefit transfer methods are used to estimate the cost of these fish lost to I&E. The annual economic cost is estimated to be between $21 and $30 million. Other research is ongoing in the context of the 2006 Cooling Water Intake Structures rule (i.e. Section 316(b) of the Clean Water Act). Griffiths et al. (2012) summarize the USEPA economic study of 316(b) which used a biological model to estimate the increase in commercial and recreational harvest levels following a reduction in fish mortality. Commercial fishing benefits were estimated using predictions of changes in commercial harvest and market data on fish prices. Recreational fishing benefits were estimated using a recreational demand model and benefit transfer. Nonuse values were not quantified. The USEPA subsequently conducted a stated preference survey of I&E that was included in the benefits analysis (USEPA 2014) that supported the final 316(b) rule.

We will review the literature to better understand national and international fish meal and oil markets. Two recent papers describe how these markets are changing. Asche, Atle, and Tveteras (2013) estimate changes in the relative prices of fish and soybean meal using time-series data. Shepherd and Bachis (2014) find similar results for fish oil. In short, the increasing demand for fish oil combined with a constant supply is leading to higher prices. This is leading to an increase in the demand for substitute oil products.

Methodological Approach

<u>Bait Fishery</u>

Primary and secondary quantitative and qualitative data will be used to assess the bait fishery and inform the allocation management discussion. Secondary data analyzed will be sourced from the Atlantic Coastal Cooperative Statistics Program as well as state fishery agencies. Additional primary data will be collected via surveys and interviews in concert with state agencies and Sea Grant programs. Primary data collection will be concentrated in states with the majority of

recorded bait landings with representation from New England, the Mid-Atlantic, and the South Atlantic to ensure sufficient geographic coverage.

A case study approach (Yin 2013) will guide the collection of qualitative and quantitative data. Cases will be developed that link the harvesting and processing and distribution sectors across the supply chain within each region of the Atlantic coast. Separate case studies will be developed for New England, the Mid-Atlantic, and the South Atlantic bait fisheries. Supply chains will be characterized that link the menhaden bait fishery with its distinct commercial markets as lobster and blue crab bait, as well as recreational markets. Finally the case studies will allow us to explore social equity, identify political and social resources upon which those fishery stakeholders rely, and investigate how social organizations and leadership impact economic resilience. We will evaluate these social and economic dimensions with established indicators following Clay et al. (2013), Pollnac et al. (2008), Smith and Clay (2010), Tuller et al. (2008), and other recent literature. Broadly, the dimensions explored will relate to financial viability, distributional outcomes, stewardship, governance, and well-being in the bait fishery, all salient socioeconomic factors to fisher communities and other fishery stakeholders (Clay et al. 2013).

Case studies will help capture the nuances and context of the bait fishery along the Atlantic coast. The institutional rules, fishing culture, and market opportunities likely vary greatly. For example the bulk of menhaden landings for bait in New England are used in the lobster fishery. Virginia and New Jersey dominate menhaden bait landings among the Mid-Atlantic states. Most of their catch is used in the blue crab pot fishery. Similarly bait harvests in the South Atlantic are dominated by landings in North Carolina, which serve the blue crab pot fishery.

Qualitative data will include semi-structured interviews with participants in the harvesting and processing and distribution sectors. Interviewees will be chosen to represent the diverse menhaden bait fishery-related occupations. They will be identified with the help of state fisheries agency databases and the Sea Grant network. The interview data will be highly valuable in characterizing the bait fishery considering the limited secondary data available. Deductive and inductive coding of the interview data will identify common themes, patterns, and trends in the socioeconomic dimensions of the bait fishery.

The interview data analyzed will inform a survey instrument designed to draw more generalizable conclusions about the bait fishery, as well as provide the data needed for further economic analyses. Surveys will capture both qualitative and quantitative data from participants in the harvesting and processing and distribution sectors of the bait fishery. They will be developed following rigorous standards with the intent to collect sufficient observations to permit statistical analysis (Dillman, Smyth, & Christian, 2008). The number of observations will depend on the accessibility of fishery participants. Surveys will be administered via mail, email, and in-person in the form of intercept surveys in order to reach the greatest number of participants in the bait fishery.

Bait and Reduction Fisheries

We will analyze landings and socioeconomic trends and the determinants of those trends in the harvesting sector of both the bait and reduction fisheries. All available commercial and recreational landings and price and cost data will be obtained from the Atlantic Coastal Cooperative Statistics Program (ACCSP), National Marine Fisheries Service (NMFS) and United States Department of Agriculture (USDA). We will apply for access to confidential data from the ACCSP state partners and also contact each state fisheries agency and the NMFS Beaufort Lab and Northeast Fisheries Science Center individually at the start of the project to obtain all available effort, landings, stock and cost data.

The modelling approach will focus at the most narrow decision-making, spatial and temporal units of analysis to the extent permitted by the available data (e.g., vessel, trip/effort, state, month). Considering the results of these trend models we will develop economic models of the bait and reduction fisheries that can be used to support economic analysis of alternative menhaden allocations. The economic component of bioeconomic fisheries models contain production functions for landings dynamics, price dynamics and fleet dynamics and effort dynamics as components. In order to better understand the determinants of trends in prices, landings and effort we will estimate trend and causal time-series models (Anderson and Seijo 2011, Prellezo et al. 2012). Tests for the standard econometric problems of endogeneity, serial correlation and spurious correlation (e.g., due to non-stationarity of the time-series) will be

conducted. These issues will be considered using standard approaches found in the economics literature (Stergiou and Christou 1996, Farmer and Froeschke 2015).[2]

Dudley's (2012) inverse demand models of the fish meal and oil markets will be updated following methods described in Park, Thurman and Easley (2004), Thong (2012) and Huang (2015). Inverse demand models can be used to estimate the consumer surplus of allocation changes.

To address the distributional consequences of management change on the Atlantic menhaden commercial fisheries we will estimate the effects of fishery landings on income, employment and other measures of economic well-being at the county/port level for Atlantic states fisheries. Panel data regression methods will be employed (Higgins, Levy and Young 2006, Whitehead and Morgan, 2011).

These regional economic data are available for download from government sources. Fishery landings data by port are available from the NMFS. We will use coastal county level per capita income and product statistics from the U.S. Department of Commerce Bureau of Economic Analysis. The county level data are available from 2001-2014 for the North American Industry Classification System (NAICS), including fisheries. These data use estimates of earnings by

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[2] We have briefly investigated the ability of annual landings and effort data from Kirkley et al. (2011) to support economic analysis. While results are very preliminary, there is evidence that landings in the reduction fishery follow a cubic pattern of effort (vessel weeks). There is also evidence that technological change, firm exit and management regimes have affected catch over time. Using publically available annual data downloaded from the NMFS website (1950-2014) estimated with an ordinary least squares model, ex-vessel real menhaden prices (assuming that Atlantic prices would equal Gulf of Mexico prices) are negatively related to landings holding constant per capita GDP and a time trend. Given that the estimated quantity flexibility is very low and the presence of positive autocorrelation exists in the data, a model with first differences is estimated. None of the independent variables have explanatory power. This is evidence that U.S. firms are not price setters in the national market but are subject to the constraints of the larger national market. Combining these two preliminary modelling efforts with cost data would be sufficient to develop an estimate of maximum economic yield in the reduction fishery. But, it is clear that publicly available data are too aggregated in terms of sector (bait, reduction), time (annual) and gear (purse seine, other) to provide enough information for management purposes. Access to the more refined data will allow the conduct of this analysis.

place of work so that fishery landings can be tied to the location of the port/fishery instead of place of residence.

Net earnings by place of work is equal to earnings by place of work minus contributions for government social insurance, contributions for government social insurance, employer contributions for government social insurance plus dividends, interest, and rent and personal current transfer receipts. Personal current transfer receipts include Social Security benefits, medical benefits, veterans' benefits, and unemployment insurance benefits. We will investigate the relationship between transfer receipts and fishery landings to determine if a relationship exists, its extent and ability to inform a social equity analysis of the menhaden fishery.

We will use labor market data from the Quarterly Census of Employment and Wages (QCEW) program from the U.S. Bureau of Labor Statistics. The QCEW includes employment and wages for almost all U.S. jobs and is available at the county level by industry.

C. Expected Outputs (deliverables)

We will produce a technical report and a non-technical executive summary. All data sets and econometrics programs will be made available, along with a user's guide. These will provide the material necessary for researchers to develop simulation models in order to analyze future allocations in the menhaden fishery.

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ADDENDUM

February 16, 2016

In this addendum to our proposal we provide additional information in response to the initial reviews and February 8 letter from the ASMFC. We provide additional detail about the bait fishery case studies, propose a stated preference survey, provide a timeline for the workplan and an updated budget for the NCSU subcontract.

<u>Bait Fishery Case Studies</u>

Dr. Jane Harrison will develop the methodology for and conduct the bait fishery case studies with the assistance of a social science graduate student with qualitative methods experience. Dr. Harrison's education and work experience include a mix of economic and non-economic environmental social science research and stakeholder engagement. Past projects have included non-market valuation studies, qualitative case studies, and survey and interview research. Harrison, Montgomery, and Bliss (2016) is an example of previous case study research conducted by Dr. Harrison. She is highly qualified to conduct the case studies detailed in this proposal. Additionally Dr. Harrison will consult with Dr. Barbara Garrity-Blake, a cultural anthropologist who serves on the North Carolina Sea Grant Advisory Board, to review the case study design, industry recruitment strategy, and qualitative data analysis. Dr. Garrity-Blake spent

many years studying participants in the menhaden industry, relying primarily on ethnographic methods to explore the cultural, historical, and social dimensions of the industry.

Case studies will be developed to illustrate the supply linkages between participants in the bait fishery harvesting and processing and distribution sectors in three regions: New England, mid-Atlantic, and South Atlantic. The bulk of menhaden landings for bait in New England are used in the lobster fishery. Virginia and New Jersey dominate menhaden bait landings among the Mid-Atlantic states. Most of their catch is used in the blue crab pot fishery. Similarly bait harvests in the South Atlantic are dominated by landings in North Carolina, which serve the blue crab pot fishery. The cases studies will not necessarily be generalizable to the bait fishery throughout the Atlantic coast, but should clarify the socioeconomic dimensions of the harvesting and processing and distribution sectors in the regions where menhaden has significant landings for the bait fishery and/or is a significant input to the bait "portfolio" of other fisheries.

The case studies will rely on interview and survey data, as well as existing data from state and federal fisheries agencies. The interview guide and survey instruments will be developed in consultation with ASFMC and solicit feedback from state fishery agencies and Sea Grant personnel to improve the instruments. Both will be piloted and further refined before final use. Both the surveys and interviews will be designed to collect information from participants in the bait fishery on the topics outlined on page six. The number of surveys collected and analyzed is dependent on state fishery agency and Sea Grant personnel support. We will rely on their existing databases of participants in the harvesting and processing and distribution sectors of the bait fishery. It is unknown at this time how extensive these databases are.

Study participation will be greatly affected by the level of cooperation of and existing bait fishery relationships held by state fisheries agencies and Sea Grant personnel. Dr. Harrison regularly requests data and collaborates with North Carolina Division of Marine Fisheries. Cooperation by other state fisheries agencies on this project will hopefully be similarly forthcoming. Dr. Harrison regularly meets with and works on regional projects with other states' Sea Grant personnel. She anticipates strong cooperation within that network.

NC State University Institutional Review Board approval will be obtained prior to survey and interview data collection. Steps to ensure confidentiality of study participants will be taken, including de-linking personal information to subjects' responses, securely storing data documents within locked locations, and properly disposing of study data when the study is completed.

Study participants may include bait harvesters, bait dealers, bait shop owners and employees, and other bait distributors. Snowball sampling will be used to identify study participants. We will initially rely on state fisheries agencies and Sea Grant personnel to identify bait fishery participants and will then recruit future subject from among the acquaintances of existing subjects.

The semi-structured interviews will last 1-2 hours, be audio recorded and transcribed verbatim. The number of interviews conducted will be based on data saturation; as new themes cease to emerge, we will discontinue the interview process. We expect to conduct approximately 50 interviews to cover the range of occupations and supply linkages in the bait fishery.

The bait fishery interviews will require approximately four 5-day data collection trips. The budget requested includes two trips with airline flights. Interviews will take place in regions where menhaden has significant landings for the bait fishery and/or is a significant input to the bait "portfolio" of other fisheries. At this point, we expect interviews to take place in Virginia and New Jersey (i.e. where there are significant landings) and Maine and North Carolina (i.e. where menhaden is a significant input to the lobster and blue crab fisheries). The states are subject to change based on the initial summary of available data from state agencies and federal data sources.

The survey form will be chosen to maximize participation by those in the bait fishery supply chain. Mail, phone, online, and intercept surveys will be considered. The form the survey takes will ultimately depend on the type of contact information (e.g. addresses, phone numbers, emails) available and pilot testing to determine the best ways to reach those in the bait fishery supply chain.

Data analyzed will include interview and survey data, as well as existing data collected from state and federal agencies. The interview data will be coded with both analytic and grounded categories. Analytic categories result from the research questions that guide this study, while grounded categories are data-driven. Codes may be acts, activities, meanings, perspectives, processes, strategies, participation, relationships, social structure, or settings. The data will be displayed in matrices to summarize and tabulate the evidence underlying the impressions, themes, concepts, and relationships regarding the socioeconomic dimensions of the bait fishery supply chain. A chain of evidence will be established with the aim that the links are explicit between the research questions asked, the data collected, and the conclusions drawn.

<u>Stated Preference Survey</u>

An update of the Kirkley et al. stated preference survey would lead to more comprehensive information on menhaden fisheries. The new survey would correct the error described in footnote 1 on page 9 of the proposal ("This [Kirkley et al.] study is limited in that it was based on the premise that the menhaden stock was not overfished and overfishing was not occurring. Subsequent to the survey design, it was determined that the menhaden stock was subject to overfishing.") and consider additional scenarios addressing potential changes in the local economy caused by menhaden management actions. In addition, the stated preference scenario would be designed to estimate changes in ecosystem service values associated with changes in the bait fishery.

<u>Reference</u>

Harrison, Jane L., Claire A. Montgomery, and John C. Bliss. "Beyond the Monolith: The Role of Bonding, Bridging, and Linking Social Capital in the Cycle of Adaptive Capacity." Society & Natural Resources (2016): 1-15.

Work Plan

	Bait Fishery Primary Outputs	Reduction Fishery Primary Outputs	Secondary Outputs
March 2016	-Request available data from state agencies & federal data sources		
April 2016	-Hire non-economics social science research assistant -Summarize available data	-Gather agency data -Summarize available data	-Literature search
May 2016	-Summarize available data -Develop interview and survey instrument	-Hire economics research assistant -Gather agency data -Summarize available data	-Literature search
June 2016	-Complete IRB requirements for interview and survey data collection	-Gather agency data -Summarize available data	-Literature review
July 2016	-Conduct interviews for case study (1) -Distribute survey	-Estimate regression models	-Literature review
August 2016	-Conduct interviews for case study (2) -Summarize and analyze survey results	-Estimate regression models	-Literature review
September 2016	-Conduct interviews for case study (3)	-Estimate regression models	
October 2016	-Summarize interview data	-Estimate regression models	
November 2016	-Analyze interview data for salient themes	-Estimate regression models	
December 2016	-Write content for technical report		
January 2017	-Write content for technical and summary report		
February 2017	-Complete technical and summary reports		